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Subject: Comments on CDM's Draft Sampling and Analysis Plan

Comments on CDM's
Draft Sampling and Analysis Plan, Remedial Investigation, Contaminant
Screening Study, Libby, Asbestos Site, Operable Unit 4

April 2002

by Roger N. Clark May 1, 2002

My comments are limited to the section

Site-Specific Operating Procedure for Data Validation of Asbestos
Results Obtained by Reflectance Spectroscopy for the Contaminant
Screening Study of the Libby Asbestos Project
Signed April 4, 2002

Hereafter, I refer to this section as the RS-SSOP

I have reviewed the rest of the Draft Sampling and Analysis Plan and
read Greg Meeker's review and agree with his review

Concerning the reflectance spectroscopy section, the text appears
to be a copy of some other analytical method where the other method
name was replaced with reflectance spectroscopy

The main points of the RS-SSOP are either impossible to achieve,
unnecessary in practice, and will result in a slowing of this
'rapid screening tool' to the point it is ineffective

Depending on the methodology used to analyze the spectroscopy data,
instrument drifts and calibration will not affect the results.
Different manufacturers' instruments have different stability responses,
and thus could process different numbers of samples before
recalibration. Further, I am not aware of any spectrometer that would
need method blanks and Laboratory Control Samples to be measured after
each analytical batch (20 samples). Recalibration need only be a
measurement of dark levels and the reflectance standard and not
wavelength and laboratory control standards. Any spectrometer that was
so unstable as to require this additional calibration of wavelength and
laboratory control samples after a batch of only 20 samples should not
be used in the first place.

Reflectance spectrometers also do not need to be calibrated to
absolute reflectance for detection methods to work well.
The standard practice is to use a reflectance standard of some
sort (various ones are available depending on the application).
Thus most methods only require a measurement to "relative
reflectance" not absolute reflectance. The standard need only
be spectrally smooth over the absorption features being searched for.
Post processing is sometimes done to finalize the spectra in absolute
reflectance, but this is a refinement that would normally not effect
results in any significant way.

Reflectance spectra are also self-verifying. For example, spectra of
minerals are well known. Components in a typical sample, like Libby
area soils which contain muscovite and other minerals have absorption
features which can be used to ascertain the wavelength calibration and

the relative reflectance calibration. Typically, the operator can monitor the spectrum of each sample and determine when the instrument is starting to drift and perform recalibrations as necessary. It is our experience with modern field and laboratory instruments that they do not drift in wavelength at a level that would effect a rapid screening method for amphibole presence. Reflectance level drifts are usually noticed as small offsets in the spectrum. As long as the offsets do not occur at wavelengths where the amphibole features are located, offsets of 10%, 20% or more would not effect rapid screening tool results. Thus, an instrument in a lab may be stable for many hours, enabling processing hundreds of spectra before recalibration to relative reflectance is necessary. Under field conditions, with changing lighting, recalibration may be more necessary. If using the sun as the light source and clouds float by, recalibration may be needed every few minutes. But in each case, the spectral quality is inherently obvious to a trained operator and can be further verified after the fact with the recorded spectra. This self verification of the data is part of the beauty of reflectance spectroscopy as a screening tool.

Reflectance spectroscopy is only a screening tool. It has good sensitivity to materials like amphiboles, but only under very restrictive conditions can the derived components be calibrated to abundance with accuracy better than factors of two (or greater). A material's response in a reflectance spectrum is dependent on projected surface area, thus both grain size and abundance of ALL COMPONENTS influence response. For example, two different Libby soils, with the same richterite grain size and abundance, but with different quartz and muscovite grain size, will show a different absorption strength of the richterite absorptions. This is because the projected surface area of some of the components changed even though the richterite surface area did not. This is why reflectance spectroscopy is a screening tool and not an analytical abundance tool. Only if grain sizes are known can reflectance spectroscopy data be analyzed for abundance.

The RS-SSOP needs to be totally rewritten to use reflectance spectroscopy as a rapid screening tool and not a rigorous abundance determination method. Reflectance spectroscopy, as a rapid screening tool can aid the sampling plan by indicating samples that do not need to be rigorously analyzed. If reflectance spectroscopy detects an amphibole, then further more rigorous analysis must be done to quantify the presence of asbestiform mineralogy.